

Remarks

The specification and drawings are amended to correct errors of a typographical or editorial nature. No new matter is introduced by any of the amendments, and entry thereof is requested.

Claims 1 - 30 are in the application, of which claims 5, 7 - 11, 21 - 23, 26 and 28 have been withdrawn as being directed to a nonelected species of the invention. Accordingly, claims 1 - 4, 6, 12 - 20, 24, 25, 27, 29 and 30 are now under consideration. Reconsideration of the application, as amended, is requested.

Applicant's invention is directed to a multipackage module having an inverted second package stacked over a first package, in which the z-interconnection between the stacked packages is by wire bonds, and in which at least one of the packages is provided with an electrical shield. The multipackage module according to Applicant's invention is made by providing a first package having an electrical shield, stacking a second package in an inverted orientation onto an upper surface of the shield, and electrically interconnecting the packages by wire bonds. According to the invention, the packages may be individually tested, and only packages determined to be "good" are used to assemble the stacks, providing improved yield in the resulting multipackage modules.

The points raised in the Office action will now be addressed, beginning with the objections to the drawings.

Drawings Objections; Amendments to the Specification and Drawings

The Examiner objected to the drawings as failing to comply with 37 CFR 1.84(p)(4), asserting that "reference characters '313' and '315' have both been used to designate the adhesive" and noting that it was unclear where the lead line from reference numeral "315" pointed. Accordingly, in FIGs. 7A, 7B and 7C, the lead line from reference numeral **315** is moved, to indicate the "solder mask", see paragraph [00140]. It is noted that reference numeral **313** indicates the underfill, see paragraph [00136].

In view of the foregoing, the objection to the drawings can be withdrawn.

The specification and drawings are additionally amended herein to correct errors of a typographical or editorial nature.

Amendments to the Drawings

The attached sheets of drawings include changes to FIGs. 6B, 7A, 7B, 7C and 8B. Sheet 5 / 20, which includes FIGs. 6A and 6B, replaces original sheet 5 / 20 including FIGs. 6A and 6B; sheet 6 / 20, which includes FIGs. 7A and 7B, replaces original sheet 6 / 20, including FIGs. 7A and 7B; sheet 7 / 20, which includes FIG. 7C, replaces original sheet 7 / 20, including FIG. 7C; sheet 8 / 20, which includes FIGs. 8A, 8B and 8C, replaces original sheet 8 / 20, which includes FIGs. 8A, 8B and 8C. In FIG. 6B previously omitted reference numerals **406** and **407** (2 instances) are added. In FIG. 7A, 7B and 7C, the lead line running from reference numeral **315** is repositioned. In FIG. 8B reference numerals **304**, **305** (2 instances) and **306** (two instances) replace erroneous instances of reference numerals **354**, **355** and **356**, respectively.

Attachment: Replacement sheets 5 / 20, 6 / 20, 7 / 20, 8 / 20

Annotated sheet[s] showing changes

Particularly, the drawings as filed included certain reference characters not mentioned in the description, and accordingly the specification and drawings are amended herein as follows:

-- 11 -- is inserted following "BGA" in paragraph [0018];

-- 47 -- is inserted following "encapsulated" in paragraph [0025];

"355" is replaced with -- 305 --, "356" is replaced with -- 306 --, and "354" is replaced with -- 304 -- (paragraph [00165]) to make the text consistent with the reference numeration of FIG. 8C and to avoid use of any reference numeral to identify more than one feature. It is noted that metal layer 355 is sandwiched between dielectric layers 354, 356 in bottom package substrate 342 (*see, e.g.*, paragraph [00157], FIGs. 8A, 8B, 8C). Accordingly, FIG. 8B is amended to make the reference numeration consistent with that of FIG. 8C, by replacing the instances of reference numerals 354, 355, 356 that are directed to the lower planar part and the legs or sidewalls of the heat spreader, and the adhesive by which the heat spreader is affixed to the substrate, with, respectively, numerals 304, 305, 306;

"84" is replaced with -- 86 -- in paragraph [00177];

-- 90, 92 -- is inserted following "embodiments of the invention" in paragraph [00180];

FIG. 6B is amended herein by insertion of missing reference numeral 406, and 407 (2 instances), to be consistent with the description and with the reference numeration of FIG. 6A.

Rejections under 35 U.S.C. § 112

Claims 6, 25 and 27 were rejected under 35 U.S.C. § 112, ¶ 2, for indefiniteness, the Examiner asserting:

As to claims 25 and 27, it is unclear what is meant by "die-down"?
The specification is not clear as to the meaning of "die-down". Does this have anything to do with which way the active layer is facing?

Presumably the Examiner intended to state "As to claims 6, 25 and 27 ..." The phrase "die-down" is discussed in Applicant's specification at paragraph [0022], referring to FIG. 3: "... as the active surface of the die faces downward in relation to an upward-facing patterned layer of the substrate, such an arrangement may be referred to as a 'die-down' flip chip package." Accordingly, this rejection should be withdrawn.

Rejections under 35 U.S.C. § 102(e)

Claims 1 - 4, 6, 12 - 20, 24, 25, 27 and 29 - 30 were rejected under 35 U.S.C. § 102(e) as being anticipated by Hoffman *et al.* U.S. 6,737,750 ("Hoffman"). The Examiner asserted, as to claims 1 and 12:

Hoffman *et al.* shows, referring to figure 13, an inverted second package 16 over a first package 12, the stacked packages being electronically interconnected by wire bonds 20a, wherein at least one package is provided with an electrical shield 33.

Applicant disagrees with the Examiner's reading of Hoffman, and the rejections of the claims for obviousness are traversed, for at least the following reasons.

Hoffman does not describe a multipackage module. Instead, Hoffman describes a multichip package having first and second die both electrically connected to one substrate. Hoffman describes ("[i]n one embodiment") a multichip package that includes a substrate having a first surface and having a first die mounted on the first surface of the substrate; a free-standing, rigid support structure disposed over the first die on the first surface of the substrate; a second die mounted on the support structure; and an encapsulant filling within the support structure, the first die, the support structure, and the second die. Both the first and second die are electrically interconnected to circuit patterns on the first surface of the substrate. (Hoffman, Summary, Col. 1, lines 39 - 55.) Hoffman also describes ("[i]n another embodiment") according to Hoffman the multichip package includes a substrate having a first surface and having a first die mounted in a flip-chip connection on the first surface of the substrate; a heat spreader having first and second surfaces disposed over the first die; a second die mounted on the first heat spreader over the first die. The second die may electrically interconnected to the first surface of the substrate by wire bonds extending through openings in the heat spreader. There may be a second heat spreader over the second die and the first heat spreader. (Col. 1, line 56 - Col. 2, line 4.)

The feature 16 in Hoffman is not a package; it is a (second) die. Referring to Hoffman Fig. 13, the multichip package includes a lower first die 12 and an upper second die 16 and a package substrate 10. Both the first die 12 and the second die 16 are electrically coupled to circuit patterns 11a on the first surface 10a of the package substrate 10 -- the first die by conductive balls 28 in a flip-chip connection and the second die by wire bonds 20a, 20b (Col. 10, lines 8 - 20).

Accordingly, Hoffman does not teach or suggest a multipackage module having an inverted second package stacked over a first package, the packages being electrically interconnected by wire bonds, as in Applicant's invention as claimed in independent claim 1.

Nor does Hoffman teach or suggest Applicant's claimed method for making a multipackage module, as there is no teaching or suggestion in Hoffman to invert a second package and stack it over a shield on a first package, and electrically interconnect the first and second packages by wire bonds. *See*, Hoffman Fig. 15, and text referring thereto, (Col. 11, line 61 - Col. 12, line 15), describing a method for making the package of Fig. 1. The method is varied to make the various other packages in Hoffman; particularly, for the packages of Fig. 12 and 13 a heat spreader 33 is provided rather than the support structure 14 of Fig. 1 (*see*, Col. 13, lines 58 - 67). Also, in the package of Figs. 7 and 9, the support structure includes a circuit film attached to the support structure, and the method includes additional steps of electrically connecting the second die to the circuit film (*see, e.g.*, Col. 13, lines 37 - 43).

Accordingly, Hoffman does not describe all the features of Applicant's claimed invention as recited in claims 1 and 12, and the rejection of these claims under 35 U.S.C. § 102(e) should be withdrawn.

Applicant disagrees with certain of the Examiner's assertions with reference to the dependent claims; these are not addressed here, inasmuch as claims 2 - 11 and 13 - 28 depend directly or indirectly from claim 1 or claim 12 and, accordingly, the rejections as to these claims should be withdrawn for the reasons stated above.

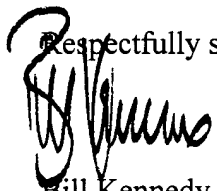
Each of independent claims 29 and 30 recites a multipackage module as claimed in claim 1, having "an inverted second package stacked over a first package, the stacked packages being electronically interconnected by wire bonds" and accordingly these claims are not anticipated by Hoffman for at least the reasons set out above.

As the Examiner noted in the Requirement for Election of Species (Paper Mailed 5-5-2004), claim 1 is generic. Accordingly, claim 1 being in condition for allowance, the Species Election Requirement can be withdrawn and all of claims 1 - 28 can be allowed.

In view of the foregoing, all the claims now in the application are believed to be in condition for allowance, and action to that effect is respectfully requested.

This Response is being filed within the first month following the three months' shortened statutory period set by the Examiner for response to the Office action and, accordingly, it is accompanied by a Petition for one month's extension of time and a fee or fee authorization therefor. In the event the Examiner may determine that additional fee[s] may be required in connection with the filing of this paper, petition is hereby made therefor, and the Commissioner is authorized to charge any additional fee (or to credit any overpayment) to Deposit Account No. 50-0869 (CPAC 1029-4).

If the Examiner determines that a conference would facilitate prosecution of this application, the Examiner is invited to telephone Applicants' representative, undersigned, at the telephone number set out below.

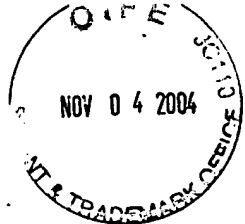
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Appendix

Replacement sheet[s]

Annotated sheet[s] showing changes



CPAC 1029-4

5 / 20

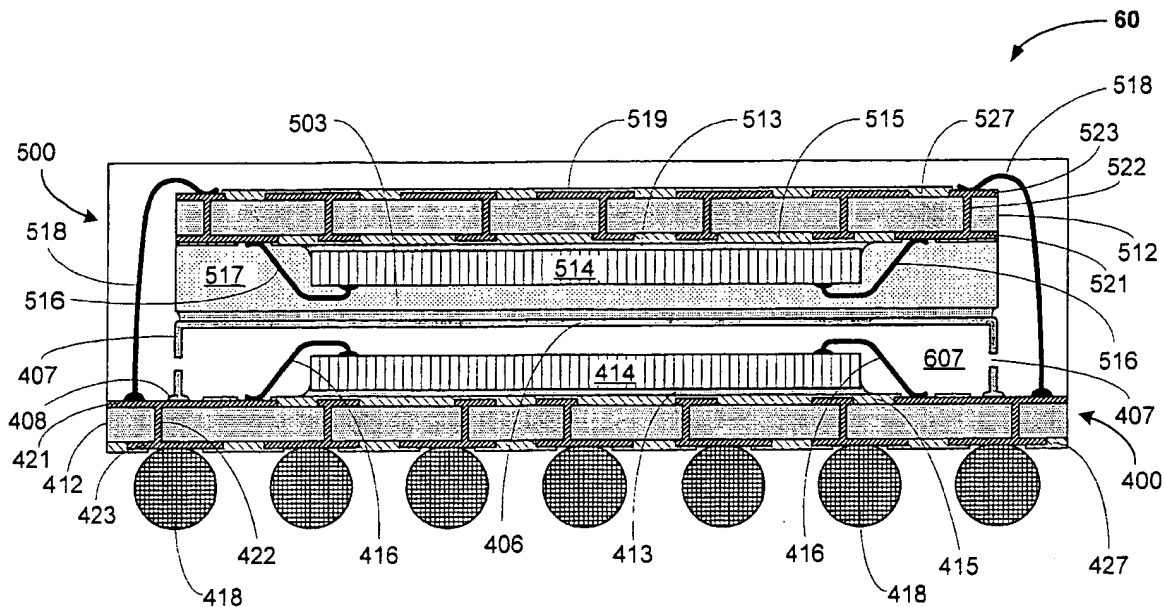


Fig. 6A

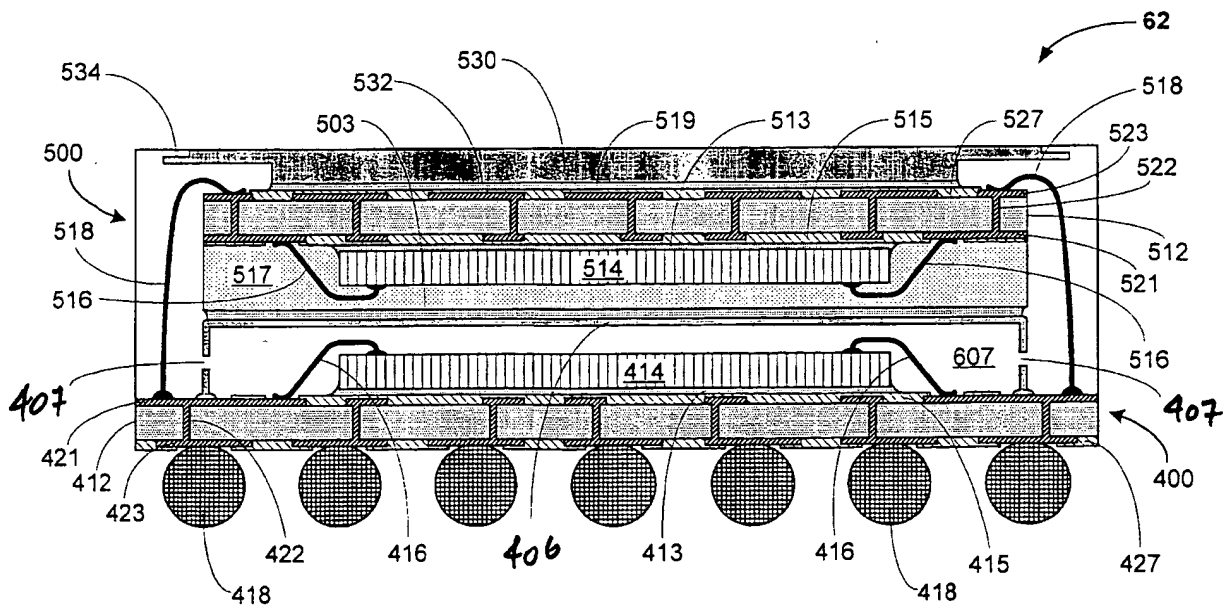


Fig. 6B

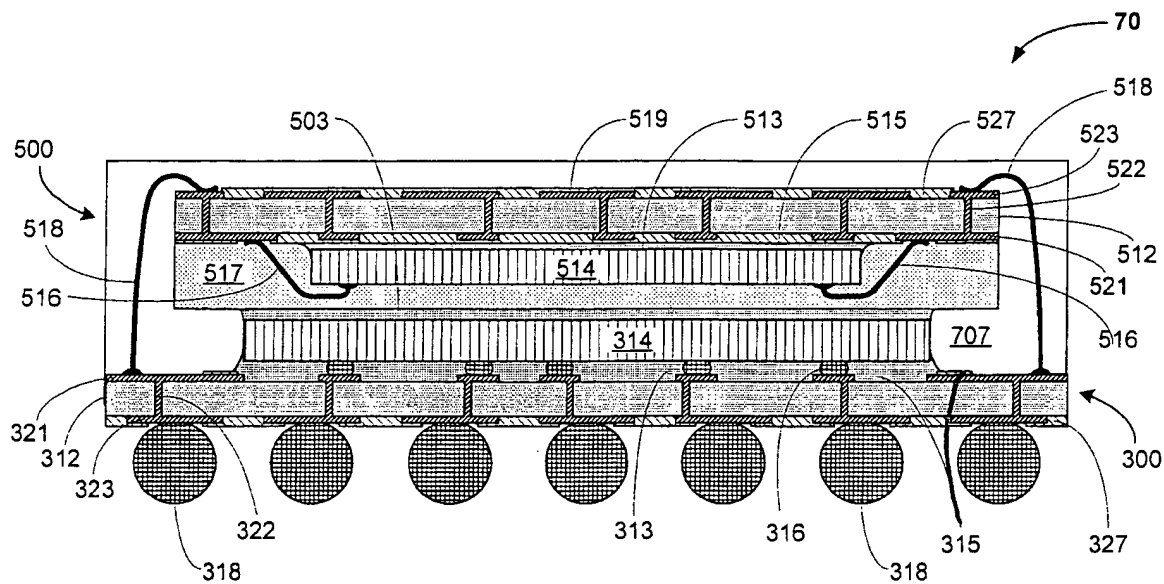


Fig. 7A

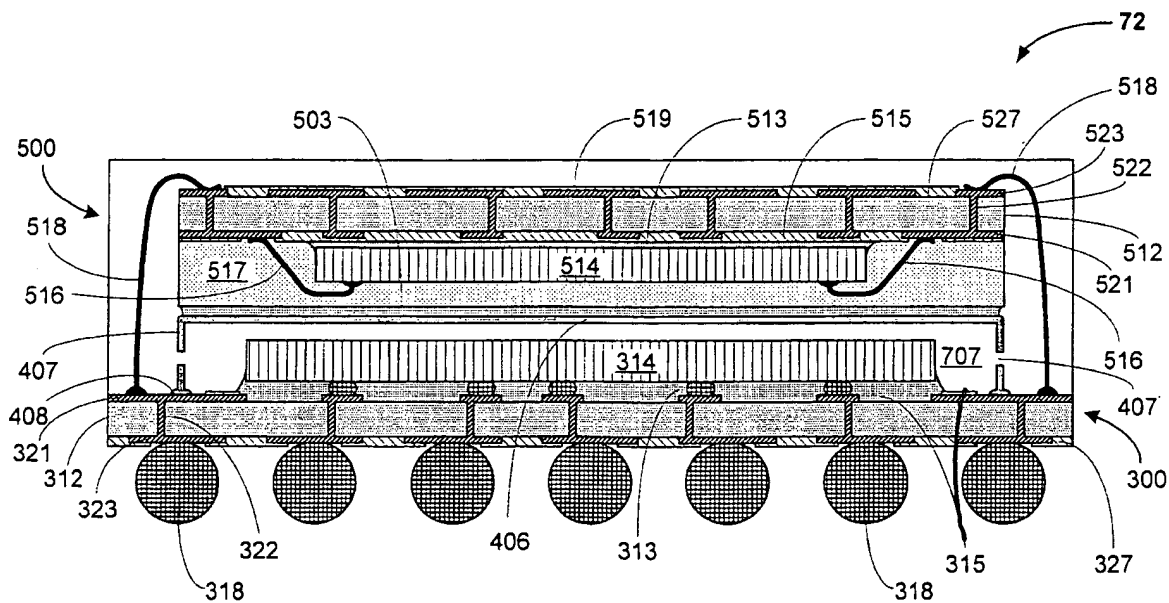


Fig. 7B

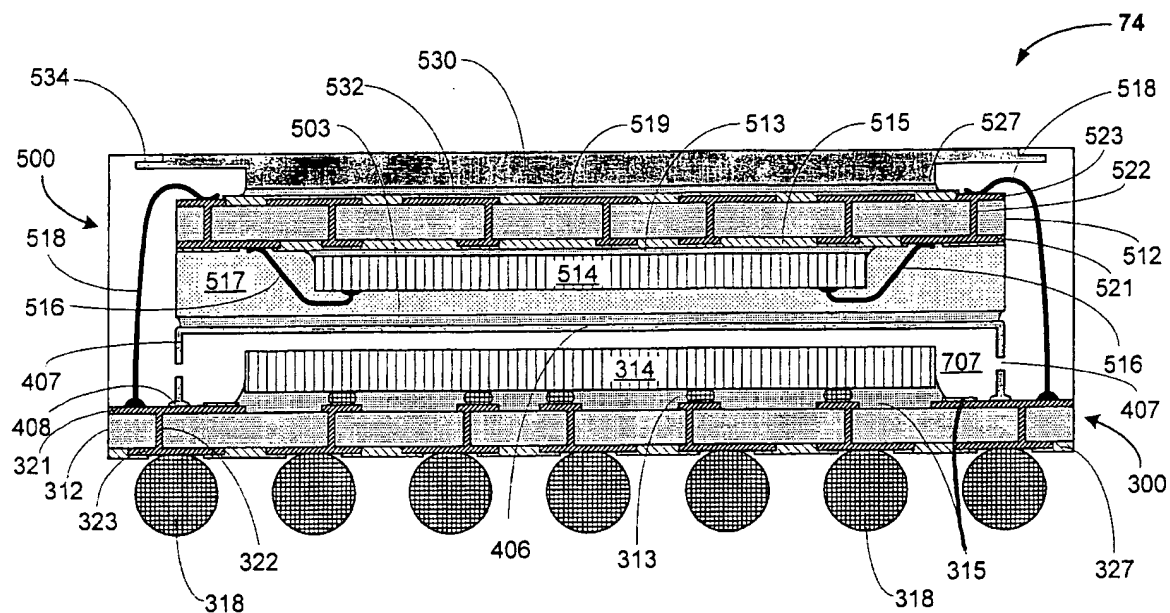


Fig. 7C

CPAC 1029-4

Annotated Sheet Showing Changes

8 / 20

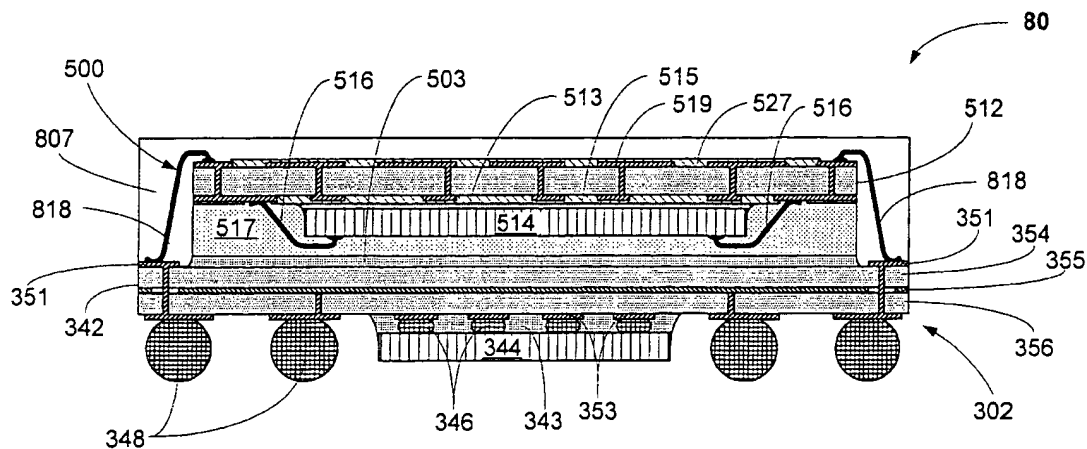


Fig. 8A

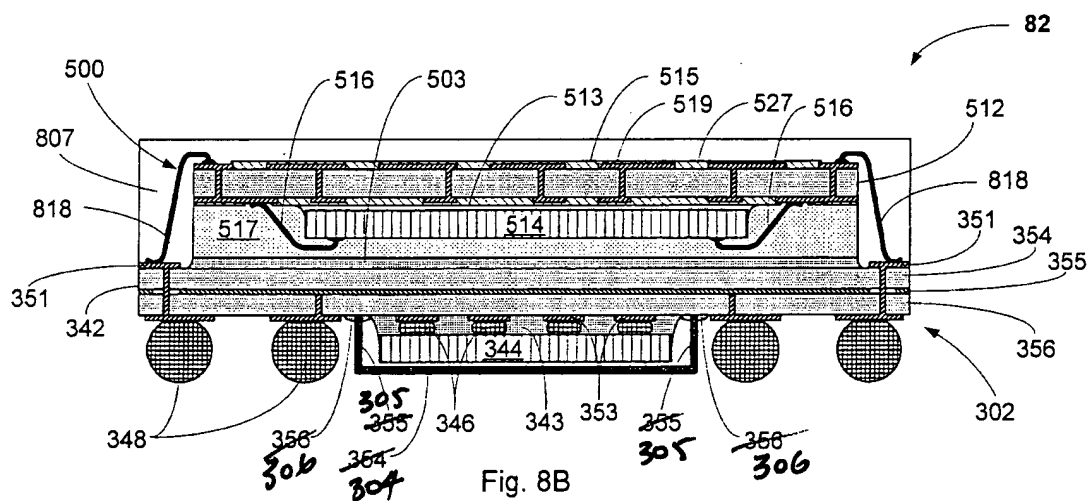


Fig. 8B

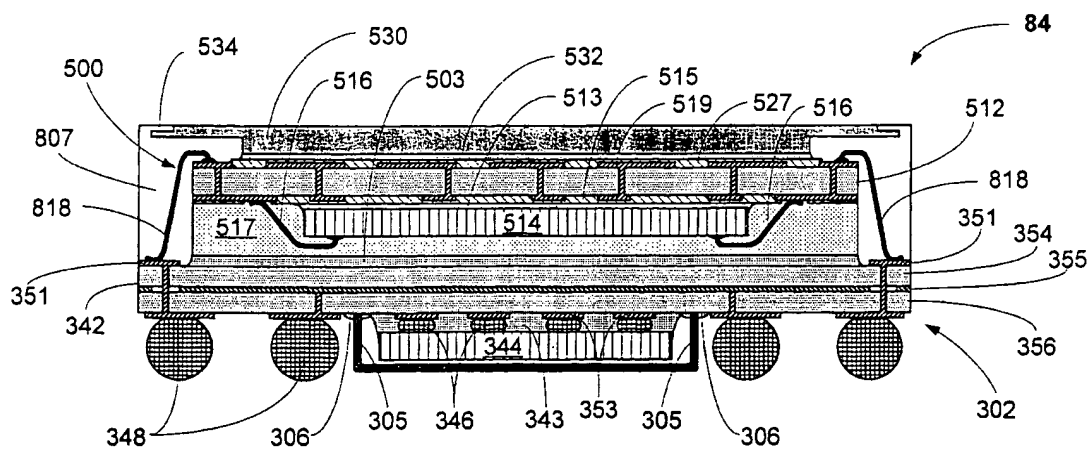


Fig. 8C